DEVICE FOR DETERMINING FLOW PARAMETERS FOR A FLUID AND METHOD FOR

OPERATING SUCH A DEVICE

The present invention relates to a device for determining flow parameters, particularly the temperature, the flow velocity and its changes, in a stream of fluid to be monitored, particularly in smoke and gas intake detectors, having a thermoelectric air stream sensor that is operated in a constant temperature mode, a thermoelectric temperature sensor, and a regulation circuit for setting an excess temperature ΔT at the air stream sensor, as well as to a method for operating such a device, a corresponding work method, and a fire recognition device or oxygen measurement device equipped with such a device.

Devices for determining flow parameters, of the type stated initially, as well as corresponding methods for operating such devices, are particularly known from heating wire anemometry. In this connection, a heated wire is introduced into a flowing fluid; information about various flow parameters can be obtained using the amount of heat taken from the fluid.

In the case of heating wire anemometry, there are two fundamental modes of operation: constant flow operation and constant temperature operation, which is used in most cases, since here, among other things, the thermal inertia of the heating wire (sensor) is circumvented and thereby greater accuracy of the sensor is achieved.

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The fundamental idea of the constant temperature operating mode
is that of reducing the influence of the thermal inertia of the
sensor in that the heating wire is kept at a constant
temperature (resistance) and the heating current required for
this is used as a measure of the flow velocity of the fluid.
For this purpose, a Wheatstone bridge circuit is generally used,
whereby the resistance and therefore the temperature of the
heating wire always has a constant value, by means of feedback.
In thermal equilibrium, the heat loss of the sensor must be
equal to the added electric power. From the point of view of
anemometry, the relationship between the fluid velocity and the
electric power is of primary interest. This relationship is
extremely complex, non-linear, and can only be described by
means of an empirical law (King) that must be modified in
accordance with the given circumstances, in each instance. In
the assessment, the use of a linearizer therefore becomes
necessary.

Fig. 1 shows the fundamental schematic of a constant temperature
anemometer. In the state of equilibrium, a certain voltage is
applied at the perpendicular diagonal C-D of the bridge, which
voltage is supplied by a servo amplifier 15. If the convective
cooling at the sensor 18 changes, then a small voltage will

occur at the horizontal diagonal A-B, which is fed back to the

perpendicular diagonal C-D of the bridge, after having been

amplified many times. In this connection, the polarity of this

feedback voltage is selected in such a manner that the bridge

equalizes automatically.

Aside from the complex relationship between the fluid velocity

and the electric power detected as the measurement parameter,

there is an additional problem in that the sensor responds to

any change in heat removal, which can also be caused by a change

in the temperature or the pressure of the flow medium, for

example. This is particularly problematic if the method is

being used continuously, in order to be able to draw reliable

conclusions with regard to the status of the pipe system in

which the fluid is flowing, for example, on the basis of changes

in the measured flow parameters.

Particularly when monitoring the air stream in intake pipe

systems in aspirative fire recognition devices or oxygen

measurement devices, it is important that a blockage or a pipe

break in the intake pipe system can be reliably detected, in

order to be able to guarantee error-free operation of the fire

recognition device or oxygen measurement device. Here, an

aspirative fire recognition device is understood to be a device

that actively draws in a representative partial amount of the

space air of a space to be monitored, at a plurality of

locations, by way of a pipeline system or channel system, and

then passes these partial amounts to a detector for determining

a fire characteristic value, or for detecting gases in the air,

particularly oxygen.

An aspirative fire recognition device essentially consists of an

intake pipe system having individual, small openings, a fan that

draws an air sample from the target space via the intake

openings of the intake pipe system, as well as a detector in

which fire characteristic values of the air sample drawn in are

subsequently determined. Since an aspirative fire recognition

device actively draws in air samples from the target space, and

therefore draws in any fire characteristic values that might be

present, such devices react to fires that are starting in much

faster and more sensitive manner than traditional solutions.

Therefore the best possible intervention possibility is

presented.

The term fire characteristic value is understood to mean

physical variables that are subject to measurable changes in the

environment of a fire that is starting, e.g. the ambient

temperature, the proportion of solids or liquids or gases in the

ambient air (formation of smoke in the form of particles or

aerosols or vapor), or the ambient radiation. An aspirative

fire recognition device is furthermore used anywhere where even

the smallest, barely perceptible fire recognition characteristic

values are supposed to be detected, and particularly serve to

monitor premises and spaces, for example those containing EDP

systems or server rooms.

In closed spaces whose furnishings and fixtures react

sensitively to the effects of water, such as EDP areas,

electrical switching or distributor rooms, or storage areas with

high-value goods, so-called inertiatization methods are

increasingly being used to reduce the risk of fire and for

extinguishing fires. The extinguishing effect that results from

this method is based on the principle of oxygen displacement.

Normal ambient air is known to be comprised of 21 vol.-% oxygen,

78 vol.-% nitrogen, and 1 vol.-% other gases. For extinguishing

and preventing fires, the inert gas concentration in the space

in question is increased, and the oxygen proportion is decreased,

by introducing an oxygen-displacing inert gas, such as pure

nitrogen. Many substances no longer burn if the oxygen

proportion drops below 15-18 vol.-%. Depending on the flammable

material present in the space in question, a further decrease in

the oxygen proportion, to 12 vol.-%, for example, might be

necessary.

Such an inert gas device for carrying out the stated

inertiatization method has essentially the following components:

an oxygen measurement device to measure the oxygen content in

the target space to be monitored; a fire recognition device for

detecting a fire characteristic value in the space air or the

target space; a control for evaluating the data of the oxygen

measurement device and the fire recognition detector, and for

sequence control of the inertiatization method; and a system for

the production and sudden introduction of inert gas into the

target space.

The oxygen measurement device serves to set the base

inertiatization level in the target space. If a threshold of

the oxygen concentration is exceeded (for example due to a leak

in the target space), the control issues a command to a special

system for introducing inert gas into the space, so that the

oxygen proportion is reduced. The oxygen measurement device

signals when the threshold value of the base inertiatization

level has been reached again. In this connection, the location

of the base inertiatization level is dependent on properties of

the space.

In a preferred use, an aspirative fire recognition system is

combined with an inert gas device for preventing and/or

extinguishing fires. In this connection, the oxygen measurement

device and the fire recognition device of the inert gas device

are integrated into the aspirative fire recognition system. The

latter then takes on the task of making the data required for

monitoring the target space available to the control, from the

air sample drawn in.

In order to be able to guarantee problem-free and, to the

greatest extent possible, maintenance-free functioning of an

aspirative device, it is necessary to continuously monitor the

volume stream of the air sample being supplied to the detector.

However, the volume stream is dependent on the mass stream and

the density of the air sample added, and this in turn is a

function of the air pressure and the temperature. Therefore

monitoring of the volume stream proves to be a complicated task

in terms of measurement technology. In order to furthermore be

able to reliably detect blockages in or damage to the intake

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pipe system, i.e. the intake openings, a high degree of

measurement accuracy with regard to the volume stream monitoring

is required. This also includes, among other things,

compensation of the influence of the air density, i.e. the air

pressure, in the case of the measurement technology being used

to monitor the volume stream.

The present invention is based on the problem that the

measurement techniques used until now for monitoring the volume

stream in intake pipe systems of aspirative fire recognition

devices are subject to overly great uncertainties, i.e. they

take into consideration only the volume stream and not the flow

resistance, in order to be able to provide reliable information

about the status of the intake pipe system. The uncertainties

are due, among other things, to the fact that the sensors used

are dependent on the temperature of the fluid stream and on the

air pressure, i.e. the density of the fluid, and are therefore

unsuitable for continuous use, without equalization. Reliable

monitoring of the volume stream in intake pipe systems

furthermore requires an assessment of the measurement data that

is as accurate as possible.

Furthermore, it is problematic, in the case of the solutions
known from the state of the art, that only volume stream changes
that last a long time are to be assessed. In this connection,
it is usual to compare these changes with threshold values,
whereby an air stream problem is reported if a threshold value
is exceeded. However, in order to avoid error messages due to
ambient influences (air pressure, temperature), relatively great
threshold values are selected. But long pipes have a high flow
resistance, so that a pipe break towards the end of the pipe
results in only a small change in the air stream. This
relatively small change in the air stream can generally not be
detected with the devices and methods known from the state of
the art.

On the basis of the problems described, the present invention is
based on the task of further developing a device for air stream
monitoring, of the type stated initially, used, in particular,
in smoke alarms and gas intake alarms, in such a manner that
continuous and maintenance-free detection of flow parameters is
possible, which are sufficiently accurate to be able to provide
reliable information about the status of the intake pipe system,
as well as the task of indicating a corresponding method for the
operation of such a device, and a corresponding work method.

This task is accomplished, according to the invention, in a device of the type stated initially, by means of a regulation algorithm that is contained in a regulation circuit of the device, and by way of which the excess temperature ΔT at the air stream sensor is kept constant.

The advantages of the invention particularly lie in the fact that the regulation circuit contains a regulation algorithm implemented in a microprocessor, by way of which the excess temperature ΔT at the air stream sensor is kept constant. In this way, the air stream sensor is precisely adjusted in its working point, i.e. working temperature, which is independent of variations or changes in the fluid temperature. Therefore the amount of heat taken from the thermoelectric air stream sensor actually corresponds only to the amount of heat taken from the fluid. In this embodiment, the electric current that flows through the air stream sensor, i.e. the electric power taken from the air stream sensor, actually represents only the measure for the flow parameter to be measured (velocity, mass stream, etc.), in advantageous manner, and is not subject to the uncertainties imposed due to variations in the fluid temperature.

The task underlying the invention is furthermore accomplished by
means of a method for operating such a device, in which the air
stream sensor is briefly raised to a peak temperature value.

The technical problem underlying the invention is furthermore
solved, according to the invention, by means of a method for
determining flow parameters, particularly the temperature T, the
flow velocity w, and its changes Δw, in a fluid stream to be
monitored, particularly in smoke and gas intake detectors, by
means of the following method steps: The fluid temperature T is
determined by means of a thermoelectric temperature sensor; the
excess temperature ΔT set at a thermoelectric air stream sensor,
operated in constant temperature mode, is regulated to a
constant value as a function of the fluid temperature T; the
amount of heat removed from the thermoelectric air stream sensor
is determined; and an evaluation algorithm implemented in the
microprocessor is used to determine flow parameters,
particularly the temperature, the flow velocity, the flow
resistance and its change, on the basis of the amount of heat
removed.

The advantages of the invention particularly lie in the fact
that a very effective method for determining flow variables,

particularly in smoke and gas intake detectors, can be achieved,

for optimization of the air stream monitoring in the pipeline

system. Particularly because the excess temperature ΔT at the

thermoelectric air stream sensor takes on a constant value,

independent of the fluid temperature T, the result can be

achieved that the thermoelectric air stream sensor is used

precisely in its previously determined working point, i.e.

working temperature, and therefore the electric power removed is

actually dependent only on the fluid stream. The measurement

error is clearly reduced because of the method according to the

invention. In the case of the thermoelectric air stream sensor

according to the invention, the amount of heat Q removed from

the heated sensor by the fluid stream is the measure for the

flow parameters to be determined. Since here, the excess

temperature ΔT takes on a constant value, the amount of heat Q

removed is identical to the heating power P supplied to the

sensor. The heating power P is dependent on the heating current

I, in accordance with the following equation (1):

$$P = I^2 \cdot R \qquad\qquad\qquad (1)$$

Here, R refers to the internal resistance of the sensor. The amount of heat Q removed from the sensor can be described as follows, by means of equation (2):

$$Q = [A + B \cdot (\rho \cdot V)^{1/n}] \cdot (\Delta T - T) \qquad (2)$$

Here, A, B, and n are sensor-specific constants that are determined experimentally before start-up of the sensor, i.e. by means of calibration, and ρ represents the fluid density. From equations (1) and (2), it follows that the volume stream V and the mass stream ($\rho \cdot V$) of the fluid stream can be determined by way of the heating power P and the temperature T.

From equations (1) and (2), it follows that the volume stream V and the mass stream $N = \rho \cdot V$ of the fluid stream can be determined by way of the heating power P and the temperature T. The flow resistance F_w in the pipe is dependent on the flow velocity w, as follows:

$$F_w = 0.5 \cdot c \cdot A \cdot \rho \cdot w^2 \qquad (3)$$

Since the volume stream V is dependent on the flow velocity w and the cross-section A of the pipe, according to

$$V = A \cdot w \qquad\qquad (4)$$

it follows for the flow resistance F_w in the pipe that:

$$F_w = 0.5 \cdot c \cdot \rho \cdot A^{-1} \cdot V^2 \qquad\qquad (5)$$

From equation (5), it follows that the flow resistance F_w in the pipeline system and its changes can be determined by way of the volume stream V.

Furthermore, it is possible, based on these measurement values, to determine the changes in the flow resistance in the pipeline system. For this, it would be necessary to compare the current measurement values with starting measurement values that are recorded and stored in memory at start-up of the system, for example. Furthermore, the method according to the invention is suitable for detecting changes in the flow resistance in the intake pipe system. For this purpose, not only is a precise volume flow measurement, but also a compensation of the influence of the air or fluid density ρ is, in order to be able to reliably determine the flow resistance. Using the stored starting values of the air stream and temperature sensors, as

well as the current temperature and, if applicable, the current

absolute air pressure, a correction factor is determined from a

table set up for this purpose. This table is required because

different intake pipe systems and different intake power values

of the fan require different correction factors. It would be

possible to record the current absolute air pressure by way of a

separately implemented sensor for air pressure measurement, for

example. Of course, other embodiments are also possible here.

Finally, the task underlying the invention is also accomplished

by means of an aspirative fire recognition device that

constantly takes samples of space air or equipment cooling air,

from a space or piece of equipment to be monitored, and passes

them to a detector for detecting a fire characteristic value, by

way of a pipeline system, and that is equipped with a device as

described above, for determining flow parameters.

Using the device according to the invention, a possibility for

carrying out the method described above is indicated.

Preferred further developments of the invention are indicated in

dependent claims 2 to 5, with regard to the determination device,

in dependent claim 7, with regard to the operating method, in

dependent claims 9 and 10, with regard to the determination

method, and in dependent claims 12 and 13, with regard to the

aspirative fire recognition device and/or oxygen measurement

device.

Thus, it is provided for the device that the microprocessor

furthermore comprises an evaluation algorithm for calculating

flow parameters using the electric heating power P of the air

stream sensor, particularly for calculating the mass stream N,

the flow velocity w, and the temperature T of the fluid stream.

The advantage of this embodiment according to the invention lies

in the fact that the regulation algorithm implemented in the

microprocessor calculates the reference resistance of the

thermoelectric air stream sensor in accordance with a precise

sensor characteristic line, and a precise regulation circuit

(e.g. PI regulator) can be formed. In this connection, the

voltage at the thermoelectric temperature sensor can be measured

using an AD converter, for example, and subsequently filtered in

order to eliminate noise and other interference. Using the

measured voltage, the temperature of the fluid stream T_0 is

calculated. The desired constant excess temperature ΔT (for

example 40°C) is added to the fluid temperature T_0. The result

is the reference temperature T_{soll} of the thermoelectric air

stream sensor. The reference resistance of the air stream

sensor is determined from this, in the evaluation algorithm of

the microprocessor, according to the precise sensor

characteristic line. The regulator regulates the voltage at the

heating wire of the air stream sensor, in order to set the

actual value of the resistance of the air stream sensor to the

reference value. In this way, the excess temperature ΔT is kept

constant, according to the invention. The electric voltage and

the electric current at or through the thermoelectric air stream

sensor are measured using an AD converter, and subsequently

filtered. From this, the electric power P is calculated, which

simultaneously represents a measure for the air stream.

In a particularly advantageous embodiment of the device

according to the invention, it is provided that the evaluation

algorithm includes the recognition of small, sudden flow changes,

particularly volume stream changes, of the fluid stream. For

this purpose, not only a precise volume stream measurement but

also a compensation of the influence of the air density is

carried out, in order to be able to assess the flow resistance

in this manner. Using stored starting values of the air stream

sensor and the temperature sensor, as well as of the current

temperature and, if applicable, the current air pressure, even

small, sudden changes in the air flow can be detected. The

fundamental idea here is that changes resulting from disruptive

ambient influences (air pressure, temperature) generally proceed

more slowly than a pipe break. The evaluation of small, sudden

changes therefore also allows the detection of sudden blockages

of a single intake opening, which occurs due to vandalism, for

example, or if a cardboard box in a high shelf unit is placed in

front of an intake opening.

In a particularly advantageous embodiment, it is provided that

the evaluation algorithm includes the compensation of a

temperature-dependent and/or pressure-dependent density change

in the fluid stream. The advantage of this embodiment lies, in

particular, in the fact that by means of taking into

consideration the temperature-dependent or pressure-dependent

change in density of the fluid stream, the electric power taken

from the fluid stream is independent of variations in the

density change of the fluid stream. In this way, the accuracy

of the flow parameters determined by means of the present

invention, particularly the flow resistance, is clearly improved.

A possible implementation of the determination device according

to the invention provides that the microprocessor contains a

memory for storing initial values of the flow parameters. The

advantage of this embodiment lies in the fact that not only can

flow parameters be calculated in the evaluation algorithm with a

high degree of accuracy, but also longer-term status changes of

the flow parameters can be detected. Since the calculation of

the gradient of the flow parameters is based on the precise air

stream values, it is advantageously possible, in this embodiment,

to measure the changes in the pipe system of a smoke and gas

intake detector, for example. Such changes can occur due to

slow or sudden blockage, cracks, or breaks. Since the excess

temperature ΔT at the air stream sensor is kept constant by

means of the invention, the gradient of the air stream

parameters is not subject to any temperature related or other

kind of shift. Likewise, it is advantageous that an

equalization of the air stream sensor that must be performed

repeatedly is eliminated.

In a possible implementation, the air stream sensor is

advantageously designed in such a manner that it can be briefly

raised to a peak temperature value. This has the particular

advantage that the air stream sensor is thereby characterized by

its particularly long life.

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For the operation of such a determination device, the air stream

sensor is preferably designed in such a manner that it can be

briefly raised to a peak temperature value of up to 500°C. In

this way, the air stream sensor is freed of accumulated

contaminants, in particularly effective manner, by means of the

short-term operation at a greatly elevated temperature. In this

connection, the entire heating power is used to burn off or

release the dirt particles that are adhering to the air stream

sensor. During this time, it is advantageous if the fan of the

aspirative fire recognition device is shut off, in order to

avoid any cooling at the air stream sensor. This cleaning

ensures that no dirt particles are deposited or accumulated at

the air stream sensor, even in continuous operation, so that the

sensitivity of the sensor is always unchanged.

A possible implementation of the invention consists of

integration of the device according to the invention, for

determining flow parameters of an aspirative fire recognition

device and/or oxygen measurement device, which takes samples of

the space air or equipment cooling air from a space or piece of

equipment to be monitored, and passes them to a detector for

detecting a fire characteristic value, by way of a pipeline

system. The advantage of this embodiment lies particularly in

the fact that the air stream in the pipe system can be monitored
precisely, and that even changes in the pipe system that might
occur due to slow or sudden blockages, cracks, or breaks can be
reliably detected. As a result, the aspirative fire recognition
device and/or oxygen measurement device is particularly reliable
and maintenance-free in use.

In another advantageous embodiment, it is provided that the air
stream sensor or the temperature sensor of the device according
to the invention is integrated particularly in the center, in
the air entry channel of a detector for fire characteristic
values of an aspirative fire recognition device and/or oxygen
measurement device. The advantage of this embodiment lies in
the fact that in this way, all the electrical components of the
aspirative fire recognition device are brought together in one
unit. As a result, the structure of such a fire recognition
device and/or oxygen measurement device can be carried out in
particularly clear and simple manner.

Finally, it is preferably provided that the air stream sensor is
disposed at a position that is narrowed in cross-section, in the
air entry channel of the aspirative fire recognition device
and/or oxygen measurement device according to the invention. By

means of this arrangement, the air stream sensor is located in a

position in which the flow velocity is increased due to the

narrowing of the cross-section. As a result, the dynamics of

the air stream sensor are also increased. In this way, even

extremely slight changes in the flow parameters can be detected

and evaluated. As a result, the sensitivity of the device for

determining flow parameters, according to the invention, is

advantageously increased. At the same time, optimization of the

monitoring of aspirative fire recognition devices and/or oxygen

measurement devices can be achieved. Of course, other

embodiments are possible here, as well.

In the following, preferred exemplary embodiments of the

invention are explained in greater detail, using the drawings.

These show:

    Fig. 1:   a fundamental schematic of a constant temperature

               anemometer according to the state of the art;

    Fig. 2:   a block diagram of the device for determining

               flow parameters according to the invention,

               according to a preferred exemplary embodiment;

Fig. 3:   a schematic representation of a preferred

embodiment of the aspirative fire recognition

device according to the invention;

Fig. 4a: a longitudinal cross-section through a detector

for fire characteristic values from the exemplary

embodiment from Fig. 3; and

Fig. 4b: a cross-section through a detector for fire

characteristic values from the exemplary

embodiment from Fig. 3.

Fig. 1 shows a fundamental schematic of a constant temperature

anemometer according to the state of the art. The fundamental

idea of the constant temperature operating mode consists in

reducing the influence of the thermal inertia of a heating wire

sensor 18 in that the sensor element 18 is always kept at a

constant temperature (resistance), and that the heating current

used for this purpose is used as a measure for the flow velocity.

For this purpose, a Wheatstone bridge circuit is generally used,

whereby the resistance and therefore the temperature of the

heating wire 18 is always kept constant, by means of feedback.

In the state of equilibrium, a certain voltage is applied at the

perpendicular diagonal C-D of the bridge, which voltage is

supplied by the servo amplifier 15. If the convective cooling

at the sensor 18 changes, then a small voltage will occur at the

horizontal diagonal A-B, which is fed back to the perpendicular

diagonal C-D of the bridge, after having been amplified many

times. In this connection, the polarity of this feedback

voltage is selected in such a manner that the bridge equalizes

automatically. In this connection, the relationship between the

flow velocity of the fluid and the anemometer voltage is not

linear, so that the use of a linearizer is necessary for further

evaluation. Usually, a direct calibration curve is used after

linearization, in order to determine the flow velocity from the

anemometer voltage. In general, the sensor 18 in the circuit

shown in Fig. 1 responds to any change in heat removal. This

can be caused, for example, also by changes in the temperature

or the pressure of the fluid. In order to carry out a highly

precise measurement of flow parameters, however, these

parameters also have to be taken into consideration. With the

fundamental schematic of the constant temperature anemometer

shown in Fig. 1, according to the state of the art, the

variation in fluid temperature with reference to an excess

temperature set at the sensor 18 is furthermore not taken into

consideration. In order to carry out the most accurate

measurement possible, it is practical to set a constant

temperature difference, i.e. an excess temperature in the sensor

18.

Fig. 2 shows a block diagram of the device according to the

invention for determining flow parameters, in accordance with a

preferred exemplary embodiment. The device according to the

invention comprises a thermoelectric air stream sensor 1,

operated in the constant temperature mode, as well as a

temperature sensor 2. The two sensors are introduced into the

flow to be measured. Control and read-out of the sensors 1, 2

takes place by way of a regulation circuit 3. This circuit

contains a regulation algorithm implemented in a microprocessor

4, by way of which the excess temperature ΔT at the air stream

sensor 1 is kept constant. Therefore it is possible to

calculate the reference resistance of the thermoelectric air

stream sensor 1 according to a precise sensor characteristic

line, and to form a precise regulation circuit. For this

purpose, the voltage U_0 at the temperature sensor 2 is first

measured using an AD converter 5. Subsequently, a filter 6 is

used to eliminate noise and other interference. In an

evaluation unit 7, the air temperature T_0 is calculated from this.

The constant excess temperature ΔT previously established is added to the air temperature T_0 in another step. The result is the reference temperature T_{soll} of the thermoelectric air stream sensor 1. The reference resistance of the sensor 1 is calculated from this, in the microprocessor 4, in accordance with the precise sensor characteristic line. Subsequently, the regulator 3 regulates the voltage at the air stream sensor 1, in order to set the actual value of the resistance to the reference value determined previously. In this way, the excess temperature ΔT at the air stream sensor 1 is kept constant.

In the determination of the flow velocity, the voltage U_1 and the current I_1 at the thermoelectric air stream sensor 1 are measured by means of an AD converter 5, and subsequently filtered with a filter 6. In another evaluation unit 7, the electric power P and the actual value of the resistance of the air stream sensor 1 are calculated from this. The electric power P that is required to keep the excess temperature ΔT constant is a measure for the air stream.

It is possible, by means of the exemplary embodiment of the device according to the invention as shown in Fig. 2, to measure the flow parameter almost without error, so that status changes

in the flow parameters, particularly the flow resistance, can

also be calculated. For this purpose, starting values of the

flow parameters are stored in a memory (not explicitly shown)

integrated in the microprocessor 4. The continuous calculation

of the gradient of the flow parameters then takes place using

the evaluation algorithm. By means of this embodiment, it is

therefore possible to detect changes in the fluid stream that

occur, for example, due to slow or sudden blockages, cracks, or

a break of the flow channel.

In the case of a change in the density of the air due to changes

in temperature and/or air pressure, the detected volume stream

of the fluid also changes, although the pipe system has remained

unchanged. A compensation of the air density change that

becomes necessary as a result is carried out in the

microprocessor 4. The compensation factor is determined using

the starting values (temperature, air stream), and the current

temperature. Optionally, an absolute air pressure sensor (not

explicitly shown) is used to measure the air pressure.

Fig. 3 shows a schematic representation of a preferred

embodiment of the aspirative fire recognition device or oxygen

measurement device according to the invention. An intake pipe

system 13 for drawing in air samples by way of various intake

openings is disposed in a target space 12. The intake pipe

system 13 is equipped with an intake detector in which the air

samples from the target space 12 are passed to a detector 8 for

recognizing fire characteristic values, i.e. for measuring

oxygen and other gases. Furthermore, a fan 14 is provided,

which serves to draw in air samples from the target space, by

way of the pipeline system. In this connection, the intake

power of the fan 14 is adapted to the related intake pipe system.

In order to be able to guarantee error-free functioning of the

aspirative fire recognition device or oxygen measurement device

shown, it is necessary to continuously monitor the air stream

passed to the detector 8 by way of the intake pipe system 13,

and to recognize a problem with the intake in timely manner.

For this purpose, the device according to the invention, for

determining flow parameters, is located in the intake detector

of the aspirative fire recognition device or oxygen measurement

device.

Fig. 4a and 4b represent a longitudinal cross-section and a

cross-section through the detector 8 for fire characteristic

values, i.e. for gases from the exemplary embodiment according

to Fig. 3. The cross-sectional line is indicated as a broken

line in Fig. 4a.   In the detector shown, the thermoelectric air
stream sensor and the temperature sensor 1, 2 are integrated
into the smoke and/or gas measurement cell of the intake
detector.   The two sensors 1, 2 are positioned in the center of
the air entry channel 9.   At the level of the air stream sensor
1, the cross-section is narrowed, in order to increase the flow
velocity.   In this way, the dynamics of the air stream sensor 1
are increased.

In a further development of the invention, the air stream sensor
1 is freed of contaminants by means of short-term operation at a
greatly elevated temperature.   During this time, the fan 14 is
turned off, in order to avoid any cooling.   The entire heating
power is used to burn up or release the dirt particles that are
adhering to the air stream sensor 1.   During this time, no air
stream evaluation takes place.   The cleaning takes place either
automatically at regular intervals, or under manual control.
The result achieved by this cleaning is that the sensitivity of
the air stream sensor 1 is not reduced due to deposits of dirt
particles, even during extended operation.

Reference symbols of the components

1   air stream sensor

2   temperature sensor

3   regulation circuit

4   microprocessor

5   AD converter

6   filter

7   evaluation unit

8   detector

9   air entry channel

10   gas sensor or smoke sensor

11   gas sensor or smoke sensor

12   target space

13   intake pipe system

14   fan

15   servo amplifier

16   resistor

17   potentiometer

18   heating wire sensor

19   voltage source

Designations of the physical variables

P   electric power

I   sensor heating current

U   sensor voltage

R   sensor resistance

V   volume stream

w   flow velocity

F_w flow resistance

C   resistance co-efficient

ρ   fluid density

N   mass stream

T   fluid temperature

Q   amount of heat removed

A   cross-section of the pipe